# Configuration and Projected Capabilities of the Common Habitat Medical Care Facility

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**The Common Habitat is a large, long-duration habitat being explored as part of a conceptual study (not an active NASA program) that uses an SLS core stage Liquid Oxygen (LOX) tank as its primary structure. It is intended for use on the Moon as part of a permanently occupied outpost, on Mars as part of an outpost that will be occupied for hundreds of days at a time, and in deep space as part of the Deep Space Exploration Vehicle where it will support crewed missions up to 1200 days in duration. A study of internal orientation and crew size resulted in a Common Habitat configuration sized for a crew of eight with a three-deck horizontal orientation. Additional work outside the scope of this paper is developing a vertical translation system, a crew mobility aids system based on wearable gecko-derived grippers, and a crew seating/restraint system. These systems are all assumed for use in conjunction with the Medical Care Facility, which is needed to maintain crew well-being during these missions, where distance from Earth precludes the possibility of evacuation to Earth. This paper describes recent improvements in the Common Habitat Medical Care Facility and associated benefits for crew survivability in long duration missions beyond Earth orbit. These improvements were made with the assistance of a NASA Pathways intern whose experience includes a tour of duty in Afghanistan as an Army combat medic with the 691st GHOST-T, attached to the 1st and 7th US Special Forces Groups as part of Operation Freedom's Sentinel, where he helped provide far-forward surgical capabilities in austere combat environments. The initial baseline Medical Care Facility was developed working in conjunction with University of Houston Space Architecture graduate students. The facility was placed on the upper deck of the Common Habitat in a location that provided privacy, operational volume, and was close to the vertical translation pathway. The notional outfitting repurposed component CAD models from unrelated studies and notionally indicated a level of care roughly equivalent to that aboard the International Space Station. The CAD modeling provided notional stowage volumes, a deployable surface, some fixed equipment, an ultrasound, and a potentially reconfigurable treatment table. While this facility is clearly a competent arrangement, it was desired to leverage available expertise and upgrade the station given the vast distances from Earth to be experienced by the Common Habitat. Key driving requirements applied to the upgrade included to provide Medical Level of Care V, offer enhanced telemedicine capabilities, provide patient physical accommodation, provide caregiver access to the patient from all sides, include sliding pocket doors for access to hygiene and to the Vertical Translation System, and to add any additional capability possible for the best achievable medical care. The first step in the facility upgrade was to quantify the current medical inventory on the International Space Station and ensure that sufficient stowage volume was present for this purpose. To that end, the ISS medical kits were reviewed, and eight full size mid deck lockers were placed in the facility. A number of additional devices were also added, based on the intern's combat medic experience. Also, two fixed shelves and one horizontal work surface were added to the Medical Care Facility, with the shelves providing storage space for the additional devices and the work surface providing a location for the caregiver to work or stage equipment. Four display monitors were added to the wall above the horizontal work surface, supporting data display, telemedicine, conferencing, or**

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**other needs. The existing treatment table was replaced with a mobile surgical stretcher-chair. Two additional doors were added to the Medical Care Facility. One leads directly to the hygiene compartment, allowing it to support medical operations in addition to providing galley/wardroom support. The other door leads directly into the Vertical Translation System. The wall adjacent to the subsystems bay was moved, adding additional volume to the Medical Care Facility. This improved caregiver access to the patient and allowed for a larger number of caregivers to be present. It also provided options for relocation of support equipment relative to the patient as needed. In the upgraded Medical Care Facility, the Surgical Stretcher-Chair and the Vertical Translation System can work together to provide incapacitated crew member transport from a site of injury on any deck of the Common Habitat to the Medical Care Facility. It can also support patient treatment in a variety of positions including a variety of sitting postures and a supine posture at a variety of pitch angles. The facility can also support caregiver office work for review of examination results, private consultation, inventory and maintenance, and a variety of other purposes. A forward activity will be to conduct evaluations of the Medical Care Facility with different medical scenarios. Additionally, ambient and task lighting selections remain as forward work. The eight mid deck lockers can be augmented to use as portable equipment carts, similar to a manner in which maintenance facility stowage was used as portable carts during the NASA Desert Research and Technology Studies in the Constellation Program. Trash accommodation will also need forward work to assess, including provision for wet trash, dry trash, and biological waste. It will be important to assess a redesign of the surgical stretcher-chair. The commercial version used in the upgrade can only enable vertical translation in the seated configuration, requiring the patient to bend both hips and knees. A possible redesign of the chair will allow for vertical translation without requiring any bending at the hip or knees. Also, the commercial version is wheeled, making it mobile in gravity but unanchored in microgravity. Work will be needed to adapt the chair for gravity-independent performance. The hygiene compartment can be redesigned for dual-use medical scrub and galley handwash facility. Pending sufficient volume, it may also be possible to place sanitation equipment in this location to clean medical tools. Finally, most space architectures have never allowed for more than one incapacitated crew member, but several scenarios could potentially injure two or more crew in the same incident. This facility could be assessed to determine its present ability to address two or more injured crew in parallel and determine the potential upper limit for number of treatable crew in a multi-crew injury scenario, or to treat polytrauma of a single patient.**

## I. Optional Supporting Materials

### A. Images

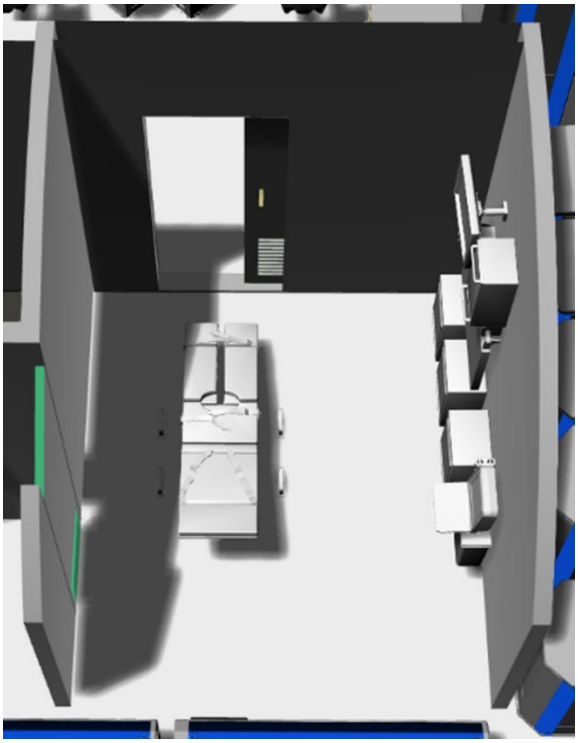

**Fig. 1 Baseline Common Habitat Medical Care Facility**

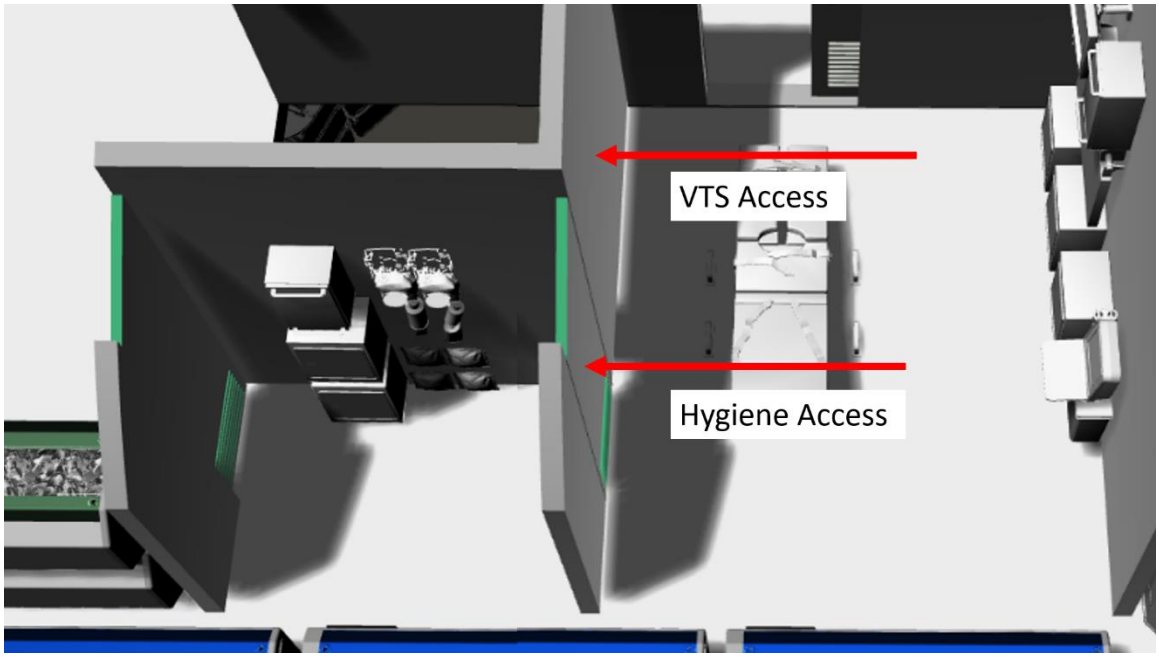


**Fig. 2 Vertical Translation System and Hygiene Access**

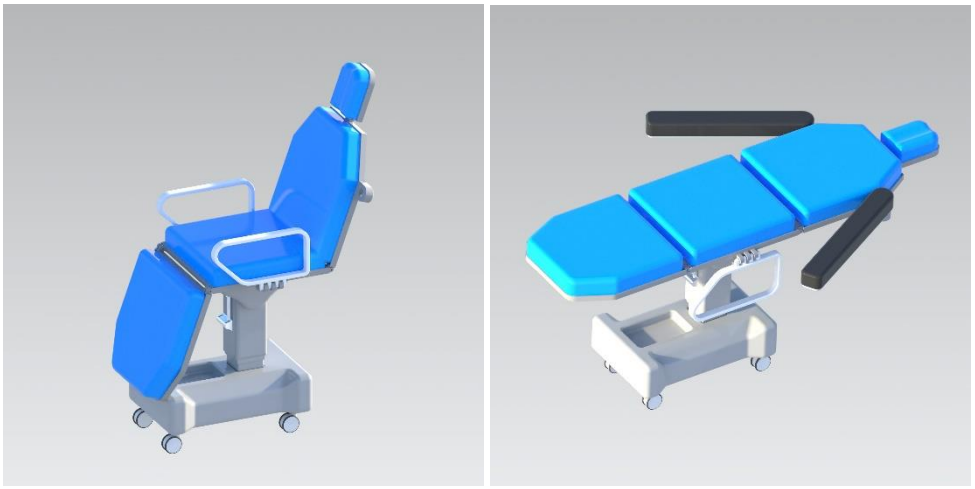

**Fig. 3 Patient Physical Accommodation**


**Fig. 4 Additional Medical Devices**

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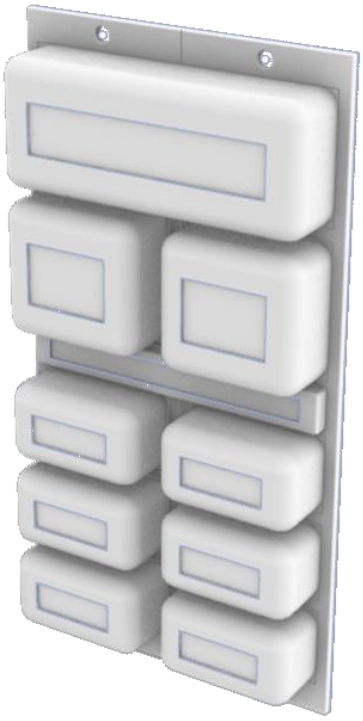

**Fig. 5 Medic and Trauma Sheet Bag**

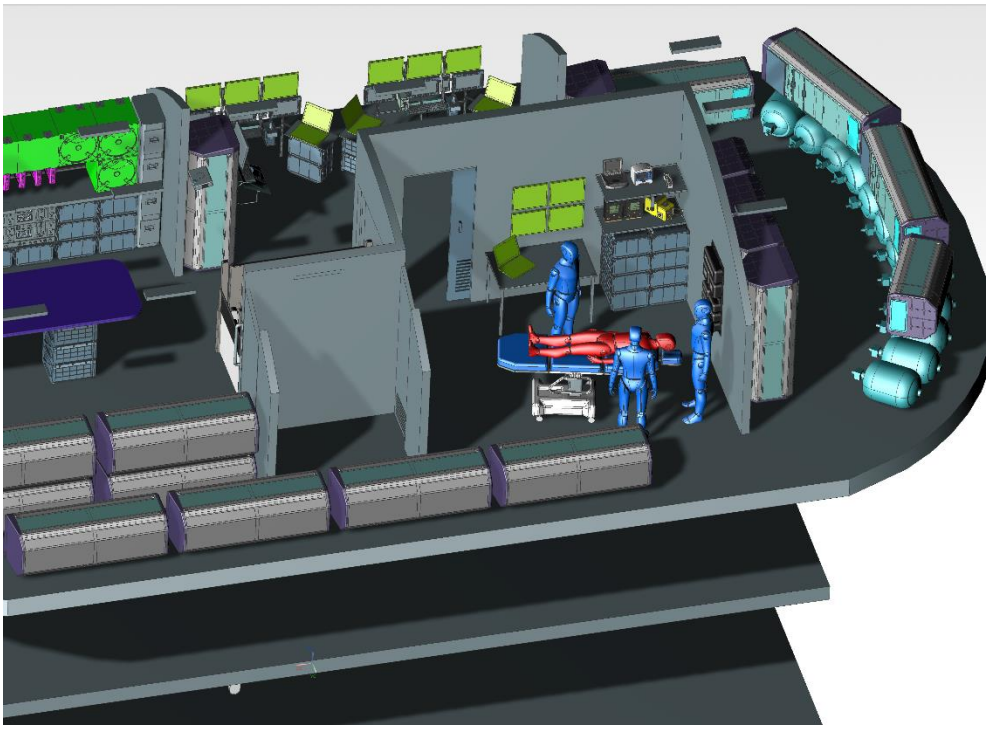

**Fig. 6 Updated Common Habitat Medical Care Facility**

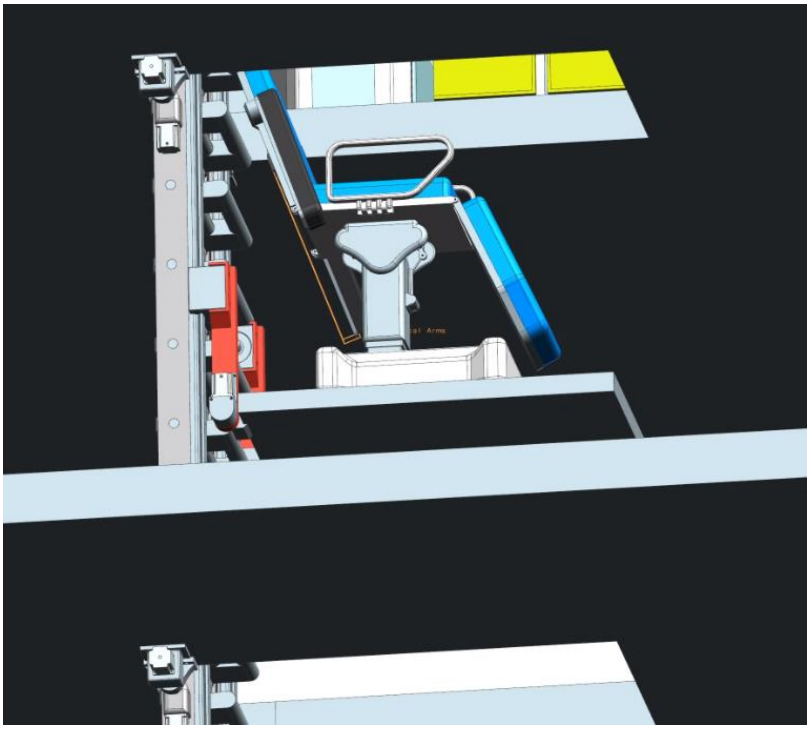

**Fig. 7 Medical Transport on Vertical Translation System**